

IN THE DRAWINGS

The attached sheet of drawing includes new Fig. 11.

Attachment: Replacement Sheet

REMARKS/ARGUMENTS

Favorable reconsideration of this application is requested in view of the above amendments and in light of the following remarks and discussion.

Claims 1-8 are pending; Claims 7 and 8 are withdrawn from consideration; Claims 1 and 4 are amended; new Fig. 11 is added; and Claim 2 is canceled. It is respectfully submitted that no new matter is added by this Amendment. New Fig. 11 is added to show the separators. This feature was discussed on at least page 7 of the originally filed specification.

In the outstanding Office Action, the drawings were objected to; Claim 4 was rejected under 35 U.S.C. § 112, second paragraph, as being indefinite; Claims 1 and 2 were rejected under 35 U.S.C. § 102(b) as anticipated by U.S. Patent No. 3,143,896 to Edwards; Claims 1, 2 and 3 were rejected under 35 U.S.C. § 102(b) as anticipated by U.S. Patent No. 3,771,382 to Wilke; Claim 4 was rejected under 35 U.S.C. § 103(a) as unpatentable over Edwards or Wilke and further in view of U.S. Patent No. 2,468,506 to Millns; Claim 5 was rejected under 35 U.S.C. § 103(a) as unpatentable over either Edwards or Wilke and further in view of U.S. Patent No. 6,513,978 to Shirai; and Claim 6 was rejected under 35 U.S.C. § 103(a) as unpatentable over either Edwards or Wilke and further in view of U.S. Patent No. 4,235,122 to Walter. It is requested that the rejections of the claims be withdrawn, and that the claims be allowed, for the following reasons.

The present invention, as set forth in independent Claim 1, is directed to a ball screw device. Specifically, as recited in independent Claim 1, the ball screw device includes a nut having a plurality of first thread grooves and a screw having a plurality of second thread grooves and a plurality of balls configured to be arranged between the first and second thread grooves. A deflector is built into the nut to provide a ball return path, the deflector is shaped as an arch and includes a pair of prop portions and an intermediate portion, the prop portions are inserted into a through hole formed into the nut and a concavity as the top plate of the

ball-return path is formed on an inner surface of the intermediate portion, wherein the arch extends a width of approximately two second thread grooves.

The present invention, as set forth in the claims, can provide numerous advantages that are not provided by the applied art. By way of a specific, non-limiting example, the combination of the features recited in independent Claim 1 can provide a ball screw device well-suited to provide a ball-return path which returns the balls so as to circulate them endlessly.

Specifically, the deflector includes the arch portion and a pair of prop portions that are fitted into the nut. A concavity is formed at an intermediate portion of the arch and defines a top plate of the ball return path. During manufacture of the ball screw device, the deflector piece is attached to the nut and inner surfaces of the nut along with an inner surface of the deflector piece are ground. Accordingly, there is no gap at a seam portion between the first thread grooves of the nut and the deflector piece. Therefore, when the nut is rotated by a motor, rotational force of the nut is smoothly transformed into force that moves the screw shaft in its axial direction by the balls being circulated. As a result, the screw shaft is moved in its axial direction. Similarly, when the screw shaft is rotated, the nut is moved in its axial direction and when one of the nut and screw shaft is moved in its axial direction, the other is rotated. Therefore, the balls circulate endlessly through the ball-roll path and the ball-return path according to the relative movement between the nut and the screw shaft.

It is submitted that none of the references of record, including Edwards, Wilke, Millns, Shirai, or Walter whether taken alone or in combination with one another, discloses or renders obvious the above-discussed features recited in independent Claim 1. It is therefore also submitted that these references do not teach or suggest the above-described advantages that are provided by the present invention.

Edwards is directed to a ball nut return guide which includes a screw 10 having a helical groove 12 and a nut 14 having an internal helical groove 16 formed to complement the screw groove. Balls 18 fill the space provided by the helical grooves of the screw and nut. The balls 18 continuously cycle through the return tube 20 secured to the body of the nut by screws 22. As best shown in Figures 2-4 the ball-return tube 20 is merely the size of a single ball 18. That is, the ball-return tube does not extend a width of approximately two of the thread grooves 16 or 12. Instead, the ball-return tube is the width of one of the grooves 16 or 12. Therefore, Edwards does not disclose the features recited in independent Claim 1 and does not provide the above-discussed advantages of the claimed invention.

Wilke is directed to a ball-threaded spindle nut with an overflow insert member. As clearly shown in Figure 2, Wilke shows guide paths formed by planar walls 4 and 4a to guide the balls 14. Further, a spherical-thread nut includes a nut housing surrounding a spindle 15 and having two adjacent thread starts having thread flanks 3 and a curve designated as 13. Upon the entrance of the ball 14 into the guide path 4 and 4a of the single transfer insert piece, the ball leaves its bearing lines at the point 10. The rectangular guide path 4 and 4a is the width of a single ball 14 and produces a grease storage space so that with the corresponding supply of grease, continuous lubrication of the spherical-thread spindle is possible.

Accordingly, Wilke does not disclose that the deflector piece is shaped as an arch and a concavity as the top plate of the ball-return path is formed on an inner surface of the intermediate portion of the deflector and wherein the arch extend a width of approximately two of the second thread grooves. Therefore, Wilke does not provide the advantages provided by the claimed invention.

As stated in MPEP § 2143.01, “[o]bviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is

some teaching, suggestion, or motivation to do so found either explicitly or implicitly in the references themselves.” In this case, it is asserted that the Office Action has not provided any required teaching, suggestion, or motivation in any of Edwards, Wilke, Millns, Shirai, or Walter to arrive at the claimed invention. Rather, the only motivation to combine aspects of these references is provided by Applicants’ disclosure.

Thus, it is submitted that a rejection of independent claim 1 in view of these references would be based on the improper application of hindsight considerations. It is well settled that it is impermissible simply to engage in hindsight reconstruction of the claimed invention, using Applicants’ structure as a template and selecting elements from the references to fill in the gaps.¹ Recognizing, after the fact, that a modification of the prior art would provide an improvement or advantage, without suggestion thereof by the prior art, rather than dictating a conclusion of obviousness, is an indication of improper application of hindsight considerations. Simplicity and hindsight are not proper criteria for resolving obviousness.² Further, it is submitted that the “fact that references can be combined or modified is not sufficient to establish *prima facie* obviousness.”³ Therefore, it is submitted that an improper “obvious to try” rationale would be required.⁴ For these reasons, it is submitted that independent claim 1 is allowable over the references of record, including Edwards, Wilke, Millns, Shirai, and Walter. The allowance of independent claim 1 is therefore requested.

Claims 3-6 are allowable for the same reasons as independent Claim 1 from which they depend. The allowance of the dependent claims is therefore requested.

¹ *In re Gorman*, 933 F.2d 982, 18 USPQ2d 1885 (Fed. Cir. 1991).

² *In re Warner*, 397 F.2d 1011, 154 USPQ 173 (CCPA 1967).

³ See Heading under MPEP 2143.01.

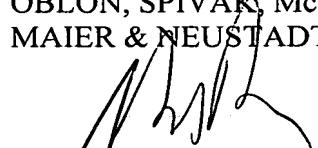
⁴ See MPEP 2145 X.B.

Consequently, for the reasons discussed in detail above, no further issues are believed to be outstanding in the present application, and the present application is believed to be in condition for formal allowance. Therefore, a Notice of Allowance is earnestly solicited.

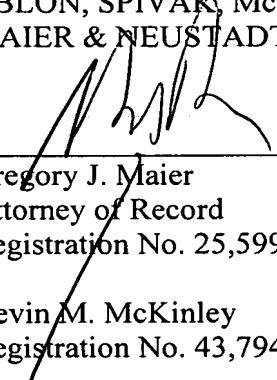
Should the Examiner deem that any further action is necessary to place this application in even better form for allowance, the Examiner is encouraged to contact the undersigned representative at the below listed telephone number.

Respectfully submitted,

OBLON, SPIVAK, McCLELLAND,
MAIER & NEUSTADT, P.C.



Gregory J. Maier
Attorney of Record
Registration No. 25,599



Kevin M. McKinley
Registration No. 43,794

Customer Number
22850

Tel: (703) 413-3000
Fax: (703) 413 -2220
(OSMMN 06/04)

CIM:KMM\dt
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